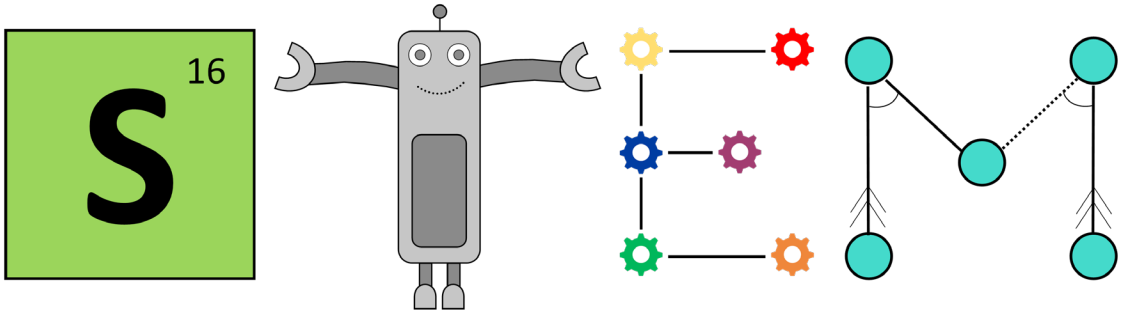
CAL RIPKEN, SR. Foundation

TRANSFORM COMMUNITIES
CHANGE KIDS' LIVES



Ripken Foundation STEM Center

Curriculum Guidebook

INTRODUCTION

ABOUT THE CAL RIPKEN, SR. FOUNDATION

During his 37-year career with the Baltimore Orioles organization, Cal Ripken, Sr. taught the basics of the game and life to players big and small. After he passed away, his sons Cal and Bill recognized that not every child is lucky enough to have such a great mentor and role model. In this spirit, the Ripken family started the Cal Ripken, Sr. Foundation, a national 501(c)(3) nonprofit organization, in 2001.

By teaching kids how to make positive choices no matter what life throws at them, the Cal Ripken, Sr. Foundation strives to help underserved youth fulfill their promise and become healthy, self-sufficient, and successful adults.

ABOUT THE CAL RIPKEN, SR. FOUNDATION STEM PROGRAM

The Cal Ripken, Sr. Foundation provides programs, resources, training, and support to community-based youth organizations across the country that directly impact the lives of underserved kids. When it comes to the fields of Science, Technology, Engineering, and Math (otherwise known as STEM), we have created a program that makes STEM activities and learning easy for mentors at community-based youth organizations to implement.

We have developed Ripken Foundation STEM Centers to facilitate STEM learning with youth partners nationwide. Each Ripken Foundation STEM Center is equipped with this STEM curriculum guidebook paired with STEM Center products and activity kits which provide a comprehensive, experiential learning environment for kids. The activities in the guidebook are designed to offer mentors many ways to teach critical thinking and problem-solving skills, all while having fun.

GUIDING PRINCIPLES OF THE CAL RIPKEN, SR. FOUNDATION

Cal Ripken, Sr. was a player, coach, and manager in the Baltimore Orioles organization for nearly four decades. He developed great players and, more importantly, great people through his style of coaching which we use as our guiding principles at the Foundation. No matter what you are teaching, you can use these four key ideas as your guide:

Keep It Simple

Lessons on the field and in life are best learned when presented in a simple manner. Teach the basics and keep standards high.

Explain Why

By helping kids understand the connections between everyday decisions and real-life outcomes, we can help them make smarter choices for brighter futures.

Celebrate The Individual

When kids are encouraged to be themselves, respected for their opinion, and are encouraged to share it, they are more likely to have a higher self-esteem and feelings of self-worth.

Make It Fun

If kids aren't paying attention or participating, how much are they learning? Whether it's using a game to teach a concept or motivating kids with a little friendly competition, keeping kids engaged is essential.

Want to hear Bill Ripken explain the guiding principles of the Foundation?
Go to **http://www.RipkenFoundation.org** *and sign up for a free account today!*

KEEPING KIDS ENGAGED

Here are some tips to help you structure activities that keep kids engaged, excited, and coming back:

- **Have a plan**
- **Keep activities structured**
- **Provide feedback**
- **Encourage, encourage, encourage**
- **Allow kids opportunities to collaborate and learn from each other**
- **Set achievable goals**
- **Let kids be silly – they're kids!**
- **Use short time increments and reminders**
- **Rotate activities frequently**
- **Let kids have input in the activities they like best**
- **Stay consistent and create routine**
- **Affirm kids when they do well**

Ripken Foundation At-Home STEM Kits

Snap Circuits

Congratulations on your new Snap Circuits kit!

Snap Circuits from Elenco are a fun and engaging way to learn about circuitry and electronics. Using pre-fabricated pieces that snap together like buttons on a coat, this kit allows you to complete over 100 different projects, including a flying saucer, musical doorbell, and motion detector. The kit comes with a project guide including instructions for how to complete the different projects. This kit also requires two AA batteries.

https://www.elenco.com/

https://www.elenco.com/for-makers/

Facebook: SnapCircuits • **Twitter:** @SnapCircuits • **Instagram:** @SnapCircuits

Additional activities and resources are available at:

http://www.RipkenFoundation.org/Ripken-STEM-Kits

LESSONS

SNAP CIRCUITS ELECTRIC BINGO

OVERALL TIME *60-minute lesson*

GROUPS *Three to four kids per kit*

Next Generation Science Standards

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound.)

(Energy 4PS3-4)

OBJECTIVE

- **Identify and construct different types of circuits.**
- **Make connections to energy sources in real life.**

OVERVIEW

Kids will engage in the basics of circuitry by building and drawing working electronic circuits.

MATERIALS

- **Snap Circuit Kit & Resource Book**
- **STEM Circuit BINGO Board**
- **Pencils/Writing Utensils**
- **Batteries (AA)**

KEY TERMS

Circuit: a complete and closed path around which electricity can flow.

Closed Circuit: an endless path for electricity to flow.

Conductor: an object or material that allows the flow of electrical current in one or more directions.

Insulator: an object or material that allows little or no electricity to go through.

Negative: the negative pole of a storage battery.

Open Circuit: an electrical circuit that is not complete.

Parallel Circuit: a circuit which has two or more paths for electricity to flow.

Polarity: attraction toward a particular object or in a specific direction.

Positive: the positive pole of a storage battery.

Series Circuit: an electrical circuit in which electricity passes through components following one path.

Short Circuit: the failure of electricity to flow properly.

LAUNCH *5 to 10 minutes*

Have kids stand in a circle. Ask the following question and give kids a moment to think.

What items do you see every day that use energy from electrical current?

Go around the circle and have each child share an example, trying not to repeat one that was already said. This activity represents how much we rely on electricity throughout a given day.

EXPLORATION *40 to 50 minutes*

Provide each team with a STEM bingo board (see page 26). Using Snap Circuits, the team will need to work together to build various types of circuits working towards a blackout bingo board (all boxes filled in). Each box of the bingo board has a different type of circuit or Snap Circuits component the team must build or incorporate in the build. Once they have built the circuit, the group must write down an example of where they might see this in real-life. For example, the flying saucer is an example of a ceiling fan, whereas a light switch is an example of a circuit with a switch.

As kids are working, walk around to each of the groups.

Possible questions to ask:

- *What circuit are you building?*
- *What order are you connecting the parts?*
- *Can you trace the path the current flows through the circuit?*

CLOSING *5 to 10 minutes*

Allow kids time to clean up and organize the Snap Circuits.

Bring the group back together. Ask kids to find a partner and answer the following questions:

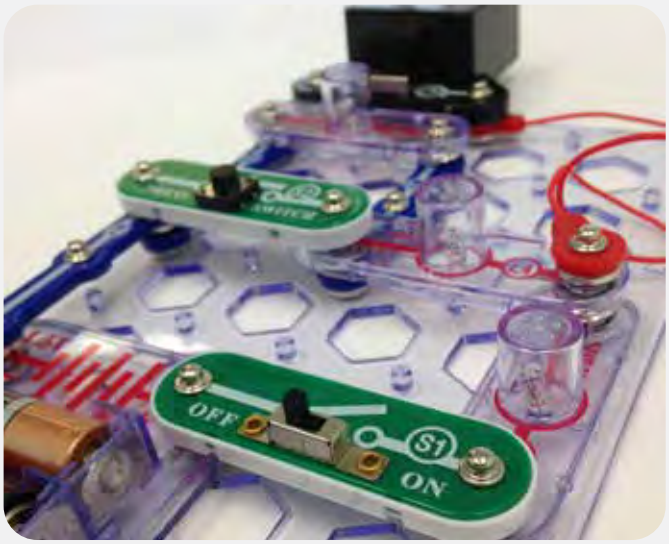
- *What new learnings did you have?*
- *What circuits were challenging to make?*
- *Why?*
- *Was your team able to make real life circuit connections?*

Choose a few partners to share aloud with the large group.

***Note:** Have teams give each other a high five to celebrate their new learning.*

ENRICHMENT AND NEXT STEPS

Allow kids to explore the Snap Circuits guidebooks and build as many circuits as they want. Challenge them to design their own and explain how it works.



SNAP CIRCUITS BINGO

NAME _____

Using Snap Circuits, build an example of each of the circuits listed below. Then in the box, write down a short description, sketch of the activity, and where have you seen an example of this in real life?

COMPLETE CIRCUIT	FLYING SAUCER	MOTOR CIRCUIT
FAN	**FREE (YOUR CHOICE)**	**PARALLEL CIRCUIT**
SWITCH CIRCUIT	**SERIES CIRCUIT**	**SOUND**

GET SNAPPED WITH SNAP CIRCUITS 3

OVERALL TIME *60- to 120-minute lesson*

GROUPS *Three to four kids per kit*

Next Generation Science Standards

4PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound.)

(4PS3 Energy)

OBJECTIVE

- **Identify and construct different types of circuits.**
- **Make connections to energy sources in real life.**

MATERIALS

- **Snap Circuit Kit (one per group)**
- **Snap Journal (one per person)**
- **Chart Paper**

PREPARATION

Copy Snap Journals for the class.
On chart paper, write the challenge and requirements.

LAUNCH *5 to 10 minutes*

Have kids form a circle. Ask them to think about what their life would be like without electricity. Are there things they would miss? Go around in a circle and have each kid name one thing.

EXPLORATION *40 to 90 minutes*

Have kids form groups of three to four. Once kids are in groups, explain that they will be exploring and interacting with basic circuitry using Snap Circuits to perform a challenge. Introduce the challenge, requirements, and Snap Journal.

CHALLENGE

Create a circuit that includes the following: light, movement, and sound.

Requirements:

- Groups will present their design.
- All kids will complete a Snap Journal.
- Each group member will be responsible for answering one or more of the following questions during the presentation:
  - *What is your Snap Circuit design?*
  - *Does your design include light, movement and sound?*
  - *Explain and demonstrate how the circuit works.*
  - *How did your team decide on this design?*
  - *Were there any challenges your team faced during this activity?*
  - *How did your team address these challenges?*

CLOSING *15 to 25 minutes*

Allow each team 3 to 5 minutes to present.

GET SNAPPED WITH SNAP CIRCUITS 4

OVERALL TIME *60- to 120-minute lesson*

GROUPS *Three to four kids per kit*

Next Generation Science Standards

4PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound.)

(4PS3 Energy)

OBJECTIVE

- **Identify and construct different types of circuits.**
- **Make connections to energy sources in real life.**

MATERIALS

- **Snap Circuit Kit (one per group)**
- **Snap Journal (one per person)**
- **Chart Paper**
- **Vocabulary cards (one set for each group)**
- **Timer**

KEY TERMS

Circuit: a complete and closed path around which electricity can flow.

Closed Circuit: an endless path for electricity to flow.

Conductor: an object or material that allows the flow of electrical current in one or more directions.

Insulator: an object or material that allows little or no electricity to go through.

Negative: the negative pole of a storage battery.

Open Circuit: an electric circuit that is not complete.

Parallel Circuit: a circuit which has two or more paths for electricity to flow.

Polarity: attraction toward a particular object or in a specific direction.

Positive: the positive pole of a storage battery

Series Circuit: an electrical circuit in which electricity passes through components following one path.

Short Circuit: the failure of electricity to flow properly.

PREPARATION

Copy Snap Journals for the class. On chart paper, write the challenge and requirements. Have a copy of the vocabulary cards cut out for each group.

LAUNCH *10 to 15 minutes*

Have children form groups of 3 to 4. Explain to kids that they will be working together to complete an electricity vocabulary match. Pass out a set of cards to each group. Then, set a timer for five minutes. After kids have discussed and completed the match, ask if they have any questions about the vocabulary words.

EXPLORATION *45 to 90 minutes*

Have kids form groups of three to four. Once kids are in groups, explain that they will be exploring and interacting with basic circuitry using Snap Circuits. Introduce the challenge, requirements, and Snap Journal.

CHALLENGE

As a team, think of an improvement to the classroom that could be made with electricity. For example, adding a doorbell to the classroom. Kids will make a model of their circuit using Snap Circuits. Teams will be allowed to use the Electronic Snap Circuits Instruction Manual. However, if the team uses the diagram from the manual to create the circuit, an additional change or modification must be made.

Requirements:

- Groups will present their design.
- All kids will complete a Snap Journal.
- Each group member will be responsible for answering one or more of the following questions during the presentation:
    - *What is your new Snap Circuit design that improved your classroom?*
    - *Explain and demonstrate how the circuit works.*
    - *How did your team decide on this design?*
    - *If you used the manual diagram, what modification did your team make?*
    - *Were there any challenges your team faced with this activity?*
    - *How did your team address these challenges?*

CLOSING *15 to 25 minutes*

Allow each team 3 to 5 minutes to present.

ELECTRICAL VOCABULARY

Circuit	a complete and closed path around which electricity can flow	**Closed Circuit**	an endless path for electricity to flow
Short Circuit	the failure of electricity to flow properly	**Series Circuit**	an electrical circuit in which electricity passes through components following one path
Positive	the positive pole of a storage battery	**Conductor**	An object or material that allows the flow of electrical current in one or more directions
Insulator	an object or material that allows little or no electricity to go through	**Negative**	the negative pole of a storage battery
Open Circuit	an electric circuit that is not complete	**Parallel Circuit**	a circuit which has two or more paths for electricity to flow
Polarity	Attraction toward a particular object or in a specific direction		

GET SNAPPED WITH SNAP CIRCUITS 5

OVERALL TIME *60- to 120-minute lesson*

GROUPS *Three to four kids per kit*

Next Generation Science Standards

4PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound.)

(4PS3 Energy)

OBJECTIVE

- **Identify and construct different types of circuits.**
- **Make connections to energy sources in real life.**

MATERIALS

- **Snap Circuit Kit (one per group)**
- **Snap Journal (one per person)**
- **Chart Paper**
- **Markers**
- **Masking Tape**

PREPARATION

Copy Snap Journals for the class. On chart paper, write the challenge and requirements.

LAUNCH *5 to 15 minutes*

Have kids form groups of three to four. Provide each group with a piece of chart paper and markers. Explain to kids that they will have ten minutes to create a list of as many electricity words as possible. When the ten minutes are up, have kids display their posters on the wall.

Then, have groups participate in a Gallery Walk to view all posters.

Choose a few kids to respond to the following questions:

- *Did you notice any words that appeared on every list?*
- *Is there a word that stuck out for you during the Gallery Walk? What word? Why?*

EXPLORATION *45 to 90 minutes*

Explain to kids that they will be exploring and interacting with basic circuitry to create a new circuit using Snap Circuits. Groups will remain the same for the challenge. Introduce the challenge, requirements, and Snap Journal.

CHALLENGE

Design your own Snap Circuit.

Requirements:

- Groups will present their design.
- All kids will complete a Snap Journal.
- Each group member will be responsible for answering one or more of the following questions during the presentation:
  - *What is your new Snap Circuit design that improved your classroom?*
  - *Explain and demonstrate how the circuit works.*
  - *How did your team decide on this design?*
  - *Were there any challenges your team faced with this activity?*
  - *How did your team address these challenges?*

CLOSING *15 to 30 minutes*

Allow each team 3 to 5 minutes to present.

EDUCATIONAL PRINCIPLES BEHIND STEM EDUCATION

EDUCATIONAL PRINCIPLES BEHIND STEM EDUCATION

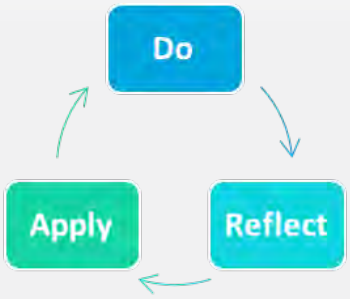
Ripken Foundation STEM Centers allow kids to learn and explore their curiosities without the confines of standardized lesson plans and testing. This curriculum guidebook is designed to give you background on the supplies we have provided, along with a set of lessons to enrich your mentoring program.

To help you curate a successful STEM program, we have provided a selection of tools that will strengthen your skills as a STEM mentor. Having these tools in your back pocket will enrich your understanding of the best practices which will enable you to teach important principles while having fun! Remember, some of these tools youth have already encountered in the classroom, so using them in afterschool mentoring programs will reinforce the skills and instill the confidence kids need to excel in STEM subjects, leading to careers in related fields.

HANDS-ON LEARNING

Hands-on learning is a key component of the Ripken Foundation STEM Centers. By having kids actively participating in a hands-on learning experience, you foster skills of inquiry, self-discovery, and problem solving, all while learning science, technology, engineering, and mathematics concepts.

The Experiential Learning Model shows how learning occurs with hands-on experiences. This model, based on the work of D.A. Kolb (1984), works on three basic principles: Do, Reflect, Apply.



Do:
Instruct the kids to conduct an activity. Kids are directly involved in the process by conducting experiments, designing solutions, and testing out ways to answer questions.

Reflect:
Ask questions to help the kids process the experience they just had. The questions offer a chance to delve deeper into the activity and understand concepts they can take away from the experience.

Apply:
Discuss other ways they can use the skills learned with other activities and experiences. The skills developed with one activity transfer to many different applications.

For example – you want your kids to build a garden. They learn how to sow seeds and care for plants, but they also learn how to plan ahead and use resources wisely. These skills developed in the garden will apply on their next project building birdhouses and beyond.

INQUIRY-BASED LEARNING

The Inquiry-based learning process allows kids to learn and grow in a supportive environment that gives them the opportunity to explore their curiosities through facilitated activities that incorporate "free play." Lessons usually begin with an introduction of concepts providing the educational background for activities. You can provide parameters and limitations such as time, budget, limited supplies, real world applications, etc. to give a context for the activities they are about to complete. After providing constructs, task kids with an open-ended challenge that allows them to explore and learn as needed within the constructs. Inquiry-based learning provides some structure for the kids on the front end, while allowing for the kids to arrive at a solution on their own or as a group.

For example – you task the kids with building the tallest tower they can in 10 minutes using only a limited number of index cards and straws. You provided the time and materials constraints, as well as gave them a goal, but left the design, use of materials, and actual construction up to the kids.

ENGINEERING DESIGN PROCESS

The Engineering Design Process (EDP) is a tool to assist with facilitation of problem solving. Children are presented with a scenario or problem, and they follow the steps of the engineering design process to imagine, create, and improve upon a solution to the issue at hand.

To help put this in context of classroom facilitation, we have created an example problem: Ellie and Henry are trying to grow three tomato plants. All three plants need to get water at the same time, but they only have one watering can. The six steps to the Engineering Design Process are as follows:

Ask:

Define the problem to address.

Scenario: We need to water three plants with one watering can.

Imagine:

Conceptualize and brainstorm ideas of possible solutions.

Scenario: How can we have the water come from one can but go three different places?

Plan:

Draw out sketches to visualize ideas including notes for assembly and constructing a model.

Scenario: Henry sketched out a picture of possible contraptions to add to the watering can. Ellie then built a working model based off Henry's drawing.

Test:

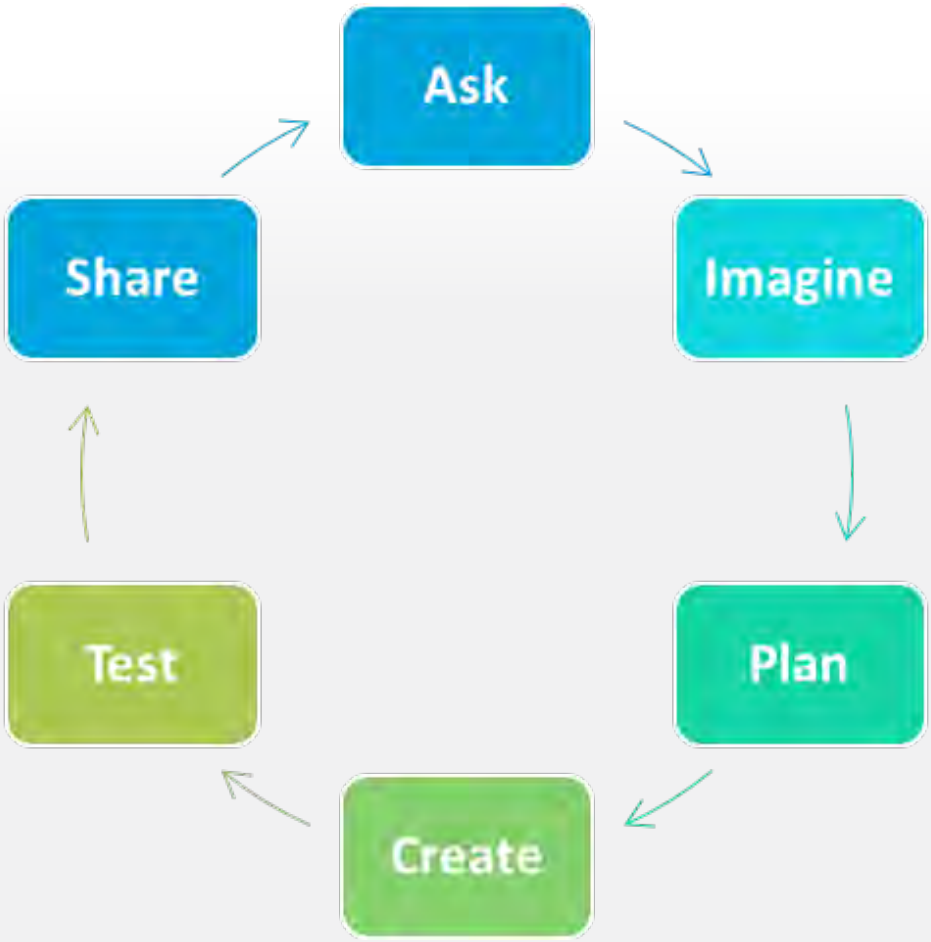
Conduct testing to determine if the plan meets the needs and solves the problem. Testing can identify improvements that need to be made and kids can go through the EDP until they are happy with a solution.

Scenario: Henry and Ellie tested their design to see if it worked. It didn't work, so they looked at the drawing and modified their model until it did what they wanted!

Share:

Engineering is a collaborative process. Kids can work in groups to create plans together, or they can offer feedback at the end.

Scenario: Ellie and Henry shared their design with their classmates, so everyone could use it and got feedback on how to make it better.



SCIENTIFIC METHOD

The Scientific Method is a process used to conduct science experiments through a logical process of problem solving and observation to help answer a question. The questions can be as simple or as complicated as you would like. Some experiments solve problems while others simply exist to satisfy a curiosity. The scientific method helps us with these questions through a step-by-step process to gather facts and arrive at an answer.

To help explain, we will follow up with Ellie and Henry's plants. They water them every day, but their plants are wilting and not growing. Ellie wants Henry's help to figure out why their plants are not growing.

STEM RESOURCES

STEM RESOURCES

These resources listed are websites and products that exist which could assist with facilitation of STEM programming.

CODING AND COMPUTER SCIENCE

Code Academy – learn coding for free

- **http://www.CodeAcademy.com**

Code.org – learn coding and programming with popular characters and games

- **http://www.Code.org**

Scratch Visual, Block-based programming language

- **http://scratch.MIT.edu**

Khan Academy Computer Science Courses

- **http://www.KhanAcademy.org/CS**

CodeCombat.com - game using coding principles, free and paid versions

- **http://www.CodeCombat.com**

Mozilla Thimble – online code editor teaching HTML, CSS, and JavaScript

- **http://https://thimble.mozilla.org/en-US**

AppInventor.org – learn to build Android apps

- **http://www.AppInventor.org**

GameBlox – create and edit games with code

- **http://gameblox.org**

MIT App Inventor

- **http://appinventor.mit.edu/explore**

ROBOTICS

Robotics activities come in all shapes and sizes. Here are a few resources to research if interested in starting a robotics program!

LEGO Mindstorms

SeaPerch

NASA Robotics

- **http://nasa.gov/audience/foreducators/robotics http://robotics.nasa.gov**

Sphero

VEX Robotics

STEM RESOURCES

3-D PRINTING

TinkerCAD – online 3D design program. Offers free lessons and design tools

- **http://www.TinkerCAD.com**

Thingverse – website with 3D design files to download and print on your own

- **http://www.Thingiverse.com**

Tinkerine U – online lessons to introduce 3D printing. Has challenges and ideas for kids to design

- **http://www.u.tinkerine.com**

SketchUp – 3D design software, has both a free and paid version

- **http://www.SketchUp.com**

Biological and Earth Sciences

Howard Hughes Medical Institute

- **www.hhmi.org/biointeractive**

EarthWatch Institute

- **http://earthwatch.org/Education**

Earth Science Activities & Experiments

- **http://www.Education.com/activity/earth-science**

MATH

MathChip – math games and activities

- **http://www.MathChimp.com**

STEMCollaborative.org – math games

- **http://www.STEMCollaborative.org**

Adventures in Math

- **http://www.scholastic.com/regions**

Math Playground – math games and activities

- **http://www.MathPlayground.com**

MathSnacks.com – math games and videos

- **http://mathsnacks.com/**

STEM RESOURCES

TECHNOLOGY AND ENGINEERING

Engineering.com – news and articles related to engineering

- **http://www.Engineering.com**

Rube Goldberg Challenges – create elaborate inventions to accomplish a simple task!

- **http://www.RubeGoldberg.com**

Engineering is Elementary – lessons and activities for educators available for purchase

- **http://www.eie.org**

TryEngineering.org – information and lesson plans related to engineering

- **http://www.TryEngineering.org**

TeachEngineering.org – lesson plans and activities that tie into the Next Generation Science Standards

- **http://www.TeachEngineering.org**

PHYSICAL AND CHEMICAL SCIENCES

PhysicsGames.net – games related to physics

- **http://www.Physicsgames.net**

Science Kids – simple experiments and activities

- **http://www.ScienceKids.co.nz/physics.html**

myPhysicsLab.com – interactive online physics simulations

- **http://www.MyPhysicsLab.com**

Algodoo – free physics simulation software

- **http://www.algodoo.com**

ChemCollective.org – online simulations and experiments related to chemistry

- **http://www.chemcollective.org/**

GENERAL STEM RESOURCES

STEM Works – articles, activities, and information about all things STEM!

- **http://www.STEM-works.com**

New Mexico State University Learning Games Lab- fun and educational games on a variety of topics

- **http://www.LearningGamesLab.org**

STEM RESOURCES

4-H National Youth Science Experiment – a new experiment released annually related to various STEM concepts

- **http://www.4-h.org/NYSD**

Magic School Bus – games, activities, and stories on a wide variety of topics

- **http://www.Scholastic.com/MagicSchoolBus**

National Geographic Kid's Website

- **http://Kids.NationalGeographic.com**

IXL.com – quizzes and activities to reinforce concepts and skills across disciplines. A preview is free but full site use requires subscription

- **http://www.ixl.com**

PBS – The Public Broadcasting Service has several pages related to education and learning

- **http://www.PBSLearningMedia.org**
- **http://www.PBSKids.org/DesignSquad**
- **http://www.PBSKids.org/**

BrainPOP – online educational videos and games. Some videos and games are free, but most require a subscripton

- **http://www.BrainPOP.com**
- **http://www.brainpop.com/games/**

Makerspace.com – Online community for the Maker movement of invention and creativity. Get and share ideas of what to create and make next!

- **http://www.MakerSpace.com**

SEA Research's STEM Mentoring Program

- **http://stemmentoringprogram.org/**

Common Sense Media – resource with ratings and information on various technology media such as games, cyber safety, and other web resources

- **https://www.commonsensemedia.org/**

STEM RESOURCES

You are on the front lines, empowering kids in your community each and every day. You're there through life's challenges, just as Cal Ripken, Sr. was for his kids and his players: teaching them how to make the best of every situation, leading by example, and encouraging them to swing for the fences.

At the Cal Ripken, Sr. Foundation, we see our role as supporting you in this shared mission. This guidebook is just a stepping-stone to start your STEM program! We hope you find ways to expand and keep your program going in perpetuity. Here are some resources to encourage program growth.

ADDITIONAL CAL RIPKEN, SR. FOUNDATION RESOURCES

For more information about the Cal Ripken Sr. Foundation, visit our website at

- **http://www.ripkenfoundation.org**

Follow us on twitter at **http://www.twitter.com/CalRipkenSrFdn**

Find us on Facebook at **http://www.facebook.com/CalRipkenSrFdn**

Check out our YouTube Channel at **http://www.youtube.com/CalRipkenSrFdn**

ACKNOWLEDGEMENTS

We would like to thank all of our sponsors for their support.